discrimination: "moreover the entire brain of an insect is white, as are all the ganglia."

On page 226, he says that the outer part of the brain is made up of a "slightly darker, usually pale grayish, white portion"—, where the tissue consists of small ganglion cells, it is naturally . . . . rather darker than in those regions where the tissue consists of the more loosely disposed, large ganglion cells."

So that we have a fundamental contradiction in reference to an alleged fundamental distinction, quite aside from the notorious fact that in the lowest vertebrates the nervous system is as "white" as in insects, and that the convoluted "mushroom" body or "cerebrum" of the ant contains sharply demarcated gray and white substances.

The chapter is accompanied, as stated, by plates of great value, most of these being fac similes of sections prepared by Mr. Norman J. Mason. On the whole, nothing new is added to our knowledge of the adult insectean brain in general, or the locust's in particular, that has not been carefully reported by Floegel, Newton and Michels. But through the great patience and skill of Mr. Mason, Professor Packard has been enabled to study sections from the embryo brain, a subject not yet worked up, owing to the difficulty of preparing the specimens. The most important results obtained is that the nerve-fibres develop from an originally finely granular substance, thus confirming the observations of Schmidt and Hensen for the mammalian embryo.

In view of the loudly trumpeted theory recently revived by Dr. J. J. Mason, after having repeatedly received the *coup de grace* at the hands of Stieda, Meynert and others, that large cells are motor, it is interesting to note that those of the optic ganglion in the locust are among the largest cells in its nervous system. R. C. S.

CORRESPONDENCE.

The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.]

To the Editor of "SCIENCE."

Limax maximas L. A specimen of this slug was brought me May 16. It came through a faucet connected with the water works. Being an introduced species and not frequently found, this fact may be of interest.

Polygala pancifolia, wild. Specimens with pure white flowers have been sent from Lunenburg, Mass., two years in succession. J. H. PILLSBURY.

SPRINGFIELD, *May* 27, 1881.

SPECTRUM ANALYSIS.

At a meeting of the Royal Astronomical Society held on the 13th of May, Mr. Norman Lockyer asked permission to offer the following address. He said:

"The chemical constitution of the heavenly bodies is one that demands some attention from astronomers. Twenty years ago the observations of Kirchoff and Stokes enabled us to get some glimpses into the chemical constitution of the sun. Kirchoff's view was that substances with which we are acquainted exist in the atmosphere of the sun, and that their presence was demonstrated by an exact matching both with respect to wave-length and intensity of the lines of certain chemical elements. Before his time Frauenhofer had noted the coincidence of the bright yellow line of sodium with the D line in the solar spectrum, but Kirchoff showed that also in the case of iron, magnesium, cobalt and several other substances there were coincidences between lines, which went to show that what was true with respect to sodium was true with respect to these other bodies. Nine years ago, we had not merely the opportunity of comparing these bright lines in the spectrum of the sun's atmosphere, as revealed to Frauenhofer, but we had the opportunity of studying the spectra obtained from very small portions of the sun's atmosphere, in regions where we should expect an exceedingly high temperature –namely, in the regions of spots and in the regions of prominences. When we began to examine these spectra, we found that the lines were thickened, and the question appeared much less clear than it did before. Of 460 iron lines recorded by Kirchoff, only three were observed in the prominences, and these were not the lines that were seen thickened in spots; so that a great many fresh questions were raised, and the idea of the decomposition of the iron by the high temperature was forced upon us. I wish to bring before you to night the results of some purely astronomical inquiries, lately undertaken by the Solar Physics Committee with respect to the behavior of the lines in the spectra of spots and prominences. We had before us the admirable work undertaken by Prof. Young in 1872, on the spectra of the prominences; but his observations only lasted for a month, and we felt that we wanted more facts, so what we have been doing at Kensington during the last two and a half years, has been to obtain and tabulate the spectra of a hundred sunspots, and these we have compared with the Italian observations of prominence lines. It was impossible to note and map down the behavior of all the lines in the spot spectra. The Committee, therefore, attempted something which was more modest, and contented themselves with observing twelve lines in the most easily visible part of the spectrum, between F and D (pinned to the blackboard was a diagram with the spectra observed placed one beneath the other, at the top were the iron lines of the Frauenhofer spectrum stated by Angstrom to be coincident with the bright lines of iron). The first point which strikes one on examining this diagram is the enormous number of iron lines, both in the solar spectrum and in the iron spectrum, as mapped by Angstrom, who used an electric arc of thirty or more Bunsen cells. They remind one of a great piano, only a few notes of which are played over and over again in the spot spectra, but always producing a different tune. If you examine the lines individually, you will find that every line has been seen with every other line. One is struck by the marvellous individuality, so to speak, of each. The lines do not go in battalions, or companies, or corporal's files, but in single units. The great importance of obtaining these observations is not so much for the observations themselves, as for the comparison they enable us to make with the observations of the lines in prominences, because the prominences are hotter than the spots. The spots are caused by down-currents where the solar atmosphere is brought down from cooler regions. They are opposed to prominences, which are ejections of heated matter from the interior of the sun. Here (pointing to the diagram) we have arranged the observations of prominences by Tacchini since 1872. What is the result? First of all, you will note a very great simplification; the brightest part of the sun has given the fewest lines. Next, there is not a single line common to the two series. In passing from the iron lines in the spots to the iron lines in the flames we pass from one spectrum to another, and the two spectra are as distinct from one another as the spectrum of magnesium is distinct from the spectrum of chlorine, or any other substance you please. These phenomena are the last we should expect. We can understand that a difference in the quantity of iron vapor present, might make a certain difference in the spectrum; but we are driven to something quite independent of any change corresponding to quantity. We see that as the temperature is increased the simplicity of the spectrum is increased; just as a chemist finds with regard to the substances which he has under his control, the function of temperature is to simplify. Why, then, if this is the result of working with increased temperature here, should not the simplification be due to the breaking

up of the iron into simpler constituents? Mr. Lockyer went on to state that the probability that the elements are so broken up by the intense heat of the lower regions of the solar atmosphere is increased by finding that many of the lines seen in the lower regions are common to more than one element. He did not believe that the bright lines seen at the beginning and end of totality which are frequently spoken of as belonging to the reversing layer correspond to the dark lines of the Frauenhofer spectrum. In witnessing another total eclipse he should concentrate his attention on two of the basic iron lines, and note their behavior at the instant of totality.

Mr. Ranyard said: It is some years since we have seen Mr. Lockyer at a meeting of the Society. I am glad to see him here again, not only for the sake of the very eloquent lecture which he has given us, but also because of the influence which a Society like this is likely to have on those who read papers before it. It gives an opportunity of criticising theories and of asking questions, which is no doubt beneficial to the person who brings the theories forward. Mr. Lockyer has referred to a theory, which he has very widely discussed, with regard to the non-elementary nature of the elements, and the evidence to be derived from solar observations, I understood him to say that he would expect a greater heat to give us a less complex spectrum.

Mr. Lockyer: I never said anything of the kind.

Mr. Ranyard; I was about to say that the reverse appears to be the case. I hope that Mr. Lockyer will afterwards take the opportunity of explaining what he means. The spectrum of the photosphere is very complicated as compared with the spectrum of sunspots and prominences. If any fact needs dwelling upon with respect to the sun, it is the number of lines which cannot be matched with terrestrial elements, and the complication of the spectrum increases as you proceed downwards to the sun's limb; that is, as you proceed from cooler to warmer regions. In the region of the Corona, very few lines have been observed; that may be, it is true, because of their faintness; but with the exception of the hydrogen lines, the lines seen in the spectrum of the Corona, which, of course, is much cooler than the region of the chromosphere, do not correspond to known lines of any terrestrial element. There is, of course, an enormous field for study here; but the fact which I want to point out, is that you do not get a simplified spectrum in the sun with greater heat, and if the facts which Mr. Lockyer has referred to with regard to the common lines in the spectra of different elements are to be relied upon, it will not follow that the common lines correspond to the similar parts of the two elements, and that the other lines correspond to mere overtones, given out with greater heat. But I should like to ask Mr. Lockyer whether he has taken note of the observations of Professor Young, who has examined these lines common to two or more elements in the solar spectrum with great dispersion, and has found that they nearly all break up into double lines or groups of lines. I think out of fifty-seven lines all but four were shown to be thus broken up, and there was some doubt about these four.

Mr. Christie said: Similar observations to those which Mr. Lockyer has described with regard to the spectra of Sunspots have been made at Greenwich, and without adopting his theory, I may say that our observations agree with those which have been made by Mr. Lockyer. We have not confined our attention merely to the iron-lines which are thickened in the spot spectrum. But we perfectly confirm what Mr. Lockyer says, namely that in the spectrum of one spot there is one group of iron-lines thickened, while in the spectrum of another spot, there will be an altogether different group affected.

Terrestrial Magnetism.—The French Government are about to establish an observatory for terrestrial magnetism at Cape Horn.

A NEW DISCOVERY IN PHOTOGRAPHY.

At the last meeting of the Photographic Society of Great Britain, Mr. L. Warnerke described the discovery he has recently patented. The discovery he said consisted in the fact that a gelatine plate submitted to pyrogallic acid became insoluble in those parts acted upon by light, exactly in the same way as gelatine was acted upon by chromic salts, the insolubility being in proportion to the amount of light and the thickness of the gelatine. This property he proposed to utilize in various ways. The drawback in the ordinary gelatine process was that unless the exposure were very accurately timed there was considerable danger of over-exposure, and, as intensification was very difficult, pictures by the gelatine process were often inferior to those by collodion. By the new process he was, however, able not only to intensify, but also to overcome the drawbacks arising from over-exposure. The latter he effected by using the emulsion on paper. He had found that no matter how much the paper was over-exposed the picture—provided the developer was restrained sufficiently—was not injured, while in the case of the emulsion on glass there was not only halation of the image, but a reversal also. The transfer of the image from paper on to the glass was a very easy matter. The paper was immersed in water and placed in contact with a glass plate. The superfluous moisture was removed by a squeegee, and the paper could then be stripped off, leaving the tissue on the glass. Hot water was then applied, which dissolved all the gelatine not acted on by light, together with the free bromide or soluble salts, and the image was left upon the glass in relief. Intensification he effected by mixing with the emulsion a coloring non-actinic matter, which was not affected by silver. Aniline colors he had found answered the purpose, and in that way special emulsion for special purposes could be prepared. That method of preparation he thought would be especially suitable for magic-lantern slides. He claimed for his discovery that by it relief could be obtained far more easily than by the ordinary bichromatised gelatine, and therefore it was especially suitable for the Woodburytype process. By mixing emery-powder with the emulsion it was rendered fit for engraving purposes, and by a combination with vitrified colors the image could be burnt in and so was adapted for enamels. In the ordinary methods of producing enamels from carbonised gelatine the latter, from the difficulty of burning it without the formation of bubbles, was a great source of trouble. By using a suitable emulsion, however, so little gelatine might be employed that this drawback was overcome. The process could also be adapted for collotype printing. In the course of his remarks, Mr. Warnerke demonstrated the removal of a gelatine picture produced by his method from paper on to glass, and showed that the mere immersion and washing in hot water fixed the picture by the dissolving of the gelatine unacted upon by light, which thus carried away the free bromide of silver. In conclusion, he stated that the sensitive paper could be used in the camera in lengths wound on rollers, and exhibited a camera which he had made for the purpose.

Captain Abney, after some remarks in reference to halation and reversal of the image, remarked that in the production of enamels by Mr. Warnerke's process there was some danger of the silver producing the well-known yellow colour which spoilt so many vitrified photographs. The discovery made by Mr. Warnerke was a most importan one, and in regard to Woodburytype, really opened up quite a new era. Mr. W. S. Bird endorsed Captain Abney's remarks as to the value of the process. To be able to produce gelatine negatives without the fear of the yellow stain was a great boon, and the only point was whether photographers would take the trouble and risk in the necessary transfers. As to its adaptability to Woodburytype, there could not be the slightest doubt. The great difficulty was to obtain the necessary relief, and he knew of a company which had recently gone to a great expense to fit up the necessary machinery, when Mr. Warnerke was able to give them what they wanted at a merely nominal cost.

Mr. T. Sebastion Davis also referred to the importance of the discovery, and suggested that by the use of the emulsion on paper a landscape might be photographed in which the clouds and the foreground might be rendered with equal truth, instead, as was too often the case, of the sky